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ANIMAL EXPERIMENTAL RESEARCH ON THE MICROSTRUCTURAL
BEHAVIOR OF THE HYALINE ARTHROIDAL CARTILAGE
AFTER IMMOBILIZATION AND REMOBILIZATION

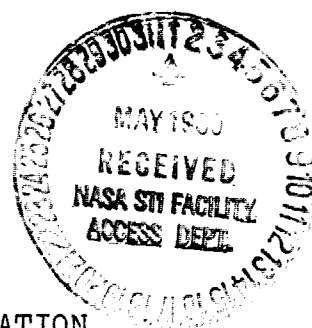
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ANIMAL EXPERIMENTAL RESEARCH ON THE MICROSTRUCTURAL
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It has been proven through numerous experimentations [1,3,4,5] and clinical research [2,4] that the immobilization of a joint can lead to degenerative alteration of the hyaline articular cartilage. However, there has been little research addressing itself to the question concerning the reversibility of such an alteration. [3]

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With the submitted animal experimental research on rabbit knee-joints, it will now be attempted to ascertain micromorphologically the alteration of the hyaline articular cartilage and investigate its reversibility.

The experiments were carried out on eighteen fully grown young rabbits whose right hind legs were immobilized, bent into an acute angle position, using an external splint for 2 to 4 weeks. At the end of this time, the first experimental group was reconditioned micromorphologically, whereby the left knee joint served as the individual control. The remaining experimental animals were remobilized for one-half a year, in order to be evaluated histologically as well as by use of the scanning and transmission electron microscopes.

After a 2 week period of immobilization, the first histological alterations in the tangential fibers and transitional zone were found, documented in a partially changed nuclear staining as well as an indicated tendency to contraction of the chondrocyte, especially in the covering layer.

With the scanning electron microscope (SEM), a localized exposure

* Numbers in the margin indicate pagination in the foreign text.

of fibrillary structures with ordered alignment was observed, without a loss of the typical surface pattern of the hyaline articular cartilage.

After a trial period of 4 weeks, increasing damage of the fine internal structure of the tangential and transitional zones was observed. This was documented histologically in the shrinking of the cells as well as in a change in color of the amorphous matrix and a simultaneous rupturing of the layer of tangential fibers. By use of the SEM /297 one is impressed now by the well defined exposure of the fibrillary structures, with rupturing and fragmenting of the same, as well as localized acute raising of the stratum of an otherwise smooth surface.

Using the transmission electron microscope, we found distinct defects in the lamina splendens as well as an unusual partially loosened or in some cases tightened collagen fibril packing. Damages to the cells were detectable.

All findings were essentially in the area of the cartilage contact zone, which because of the way in which the immobilization was carried out, must be perceived as a stress area.

Following the remobilization, the evaluated results of both experimental groups rendered no evidence of a reversibility of the observed transformations. Furthermore, with respect to the experimental series involving the group immobilized for 4 weeks, an increasing degeneration of the cartilage was demonstrated, which corresponded to the morphological picture of arthrosis.

This fact is understandable when one considers that, according to OTTE, the growth of the chondrocyte begins from the cell layer near the joint. But since it is exactly these zones of the hyaline articular cartilage which, due to experimentation, were affected by increasing disintegration, the observed degenerative changes which occurred after the remobilization appear to be a pathogenic consequence.

The reversibility of the damaged cartilage suspected by Evans

et al., after an immobilization period under 30 days, could not be confirmed.

Agreement does exist however, in the fact that the amount of degenerative change of the cartilage is dependent upon the type as well as the length of immobilization. As has been proved by other authors [1,3,5], the resulting stress of an immobilized joint (as opposed to a joint in a completely relaxed position), leads to an accelerated degeneration of the articular cartilage. The presence of a shaking movement, as was given in the related experimentation instructions, and as they more or less exist with the use of a cast, present an additional noxa.

MATTHIASS and GLUPE show correctly that, for the clinic, the imperfect fixation of joints is in no way a matter of indifference.

Even though the results of the animal experiments mentioned before cannot be immediately applied to humans, the assumption is justified that, for example, after a therapeutic immobilization of human knee joints in a support cast or plaster cast, the same degeneration of the articular cartilage might occur. As a consequence, stress of this type should be held to a minimum during the therapeutic immobilization of the lower extremities.

Summary

Early degenerative changes of the articular cartilage in knee joints of rabbits were observed after immobilization and weight bearing. These changes were not reversible. After remobilization there was an increase in the alterations. The clinical significance of these findings is discussed.

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